Evidence Based Report

Submental intubation in patients with panfacial fractures: A prospective study

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ABSTRACT

Submental intubation is an interesting alternative to tracheostomy, especially when short-term postoperative control of airway is desirable with the presence of undisturbed access to oral as well as nasal airways and a good dental occlusion. Submental intubation with midline incision has been used in 10 cases from October 2008 to March 2010 in the Department of Oral and Maxillofacial Surgery, Manipal College of Dental Sciences, Mangalore. All patients had fractures of the jaws disturbing the dental occlusion associated with fracture of the base of the skull, or/and a displaced nasal bone fracture. After standard orotracheal intubation, a passage was created by blunt dissection with a haemostat clamp through the floor of the mouth in the submental area. The proximal end of the orotracheal tube was pulled through the submental incision. Surgery was completed without interference from the endotracheal tube. At the end of surgery, the tube was pulled back to the usual oral route. There were no perioperative complications related to the submental intubation procedure. Average duration of the procedure was less than 6 minutes. Submental intubation is a simple technique associated with low rates of morbidity. It is an attractive alternative to tracheotomy in the surgical management of selected cases of panfacial trauma.

Key words: Airway management, panfacial fractures, submental intubation

INTRODUCTION

Panfacial fractures involve the cranium, midface and the mandible.[1] Early reconstruction of patients with panfacial fractures by open reduction and rigid internal fixation is now the standard of care. An important consideration at the time of surgery is the maintenance of airway without interfering with the reconstruction of fractured segments. Essentially the anaesthesiologist and the surgeon are competing for the same space. The surgeon needs access to an unobstructed field; and in most instances; maxillomandibular fixation is required intraoperatively for adequate reconstruction of facial fractures.[2,3] Therefore, in these types of injuries, the mode of intubation is controversial, with many anaesthesiologists arguing against nasal intubation. Oral intubation may interfere with proper maxillomandibular reduction. Surgical correction of maxillofacial trauma frequently requires maxillomandibular fixation. In situations where maxillomandibular fixation is required and nasoendotracheal intubation is contraindicated, a cricothyrotomy or tracheostomy has been the traditional method of airway control.[4] Submental intubation technique consists of passing the tube through the anterior floor of mouth, allowing free intraoperative access to oral cavity and nasal pyramid without endangering patients with skull base trauma. Submental intubation, thus, as an alternative to tracheostomy can be used when short-term postoperative control of airway is desirable with the presence of undisturbed access to oral as well as nasal airways and a good dental occlusion. Accordingly, unnecessary surgery and potential complications associated with either a cricothyrotomy or tracheostomy can be avoided by using the submental intubation. Once the oroendotracheal intubation is achieved, it can be converted to a submental intubation.

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The purpose of this study was to describe the preoperative status and outcome of a series of patients who had submental intubation for surgical correction of panfacial trauma.

MATERIALS AND METHODS

This prospective clinical study was conducted from October 2008 to March 2010 after obtaining the clearance from the institutional ethical committee. Ten male patients of mean age 26.2 years (range, 20-35 years) who had midfacial fractures, including Le Fort I, Le Fort II, Le Fort III, along with naso-orbital ethmoidal (NOE), mandibular fractures requiring surgical corrections, and in whom the oral and nasal intubations were not suitable otherwise, were selected for the study. Multi-trauma patients presenting with severe neurological damage, major thoracic trauma; and patients for whom repeated operations were anticipated were excluded from the study.

The technique used for submental intubation was an adaptation of the general principles published by *Hernandez Altemir (1986)*.[5]

Operative procedure

All the subjects had their trachea intubated orally by standard direct laryngoscopy either awake or after induction of general anaesthesia with a reinforced (spiral-embedded) tracheal tube having an internal diameter of 7.5 or 8.5 mm. The orotracheal intubation was then converted to a submental endotracheal intubation by using the following procedure.

After sterile painting and draping of chin and mouth, lignocaine 2% with 1:80,000 adrenaline was infiltrated at the incision site [Figure 1]. A midline incision of 1.5 cm in length was made anterior to inferior border of mandible at the chin level. A curved haemostat was passed from the submental incision through the subcutaneous layer, platysma, mylohyoid muscle, submucosal layer and mucosa [Figure 2]. After entering the oral cavity at the junction of the attached lingual alveolar mucosa and the free mucosa of the floor of the mouth, an incision of 1.5 cm in length was made parallel to the gingival margin. The haemostat was opened to create a soft tissue passage for the endotracheal tube. With the curved haemostat, the deflated pilot tube cuff was passed extraorally. Then the endotracheal tube was disconnected from the breathing circuit and the standard connector removed from endotracheal tube. Disconnection of the standard connector from the endotracheal tube facilitated easy passage of the endotracheal tube through the submental incision. To prevent any inadvertent pull being exerted on the tube from larynx, the tube was then manually stabilized and the tip of the endotracheal tube gently pulled out through the submental incision with the help of a curved haemostat. After confirmation of its adequate tracheal position by capnography and bilateral auscultation of the lungs, the tube was reconnected and secured to the skin of the submental area with 3-0 silk sutures [Figure 3]. Intraorally the tube was positioned between the tongue and the mandible just above the mucosa of the floor of the mouth [Figure 4]. The tube should be freely movable to allow for intraoral manipulation.

Anatomical reduction and rigid internal fixation of the maxillofacial fractures were achieved by using miniplates osteosynthesis. Temporary maxillomandibular fixation was used in all cases to achieve optimal maxillomandibular reconstruction. Absence of nasotracheal tube allowed

Figure 1: Anesthetizing the local area

Figure 2: Incision placed and tunnelling done on the medial side of mandible to approach the floor of mouth

the reduction of naso-orbital ethmoidal (NOE) fractures to be completed easily.

At the end of the surgery, the maxillomandibular fixation was released and submental intubation converted to oral intubation. The endotracheal tube was pulled back intraorally in the reverse order (first the reinforced tube, then the pilot tube cuff). The submental skin incision was closed with interrupted silk sutures and the intraoral incision left to heal secondarily.

The patients were followed up on regular basis at 1 week, 1 month and 6 months. Assessment was based on postoperative morbidity in terms of function and aesthetics.

RESULTS

Patients' demographic and clinical data are presented in Table 1. The intubation method itself did not lead to any intraoperative complications. In all the subjects, submental intubation allowed simultaneous treatment of all the fractures without changing the method of intubation and without any interference from the tube during the operation.

There was no difficulty in passing the tube through the floor of mouth, and the total duration of submental intubation procedure ranged from 5 to 8 minutes (mean, 5.9 minutes). Disconnection of the standard connector from the tube was done easily. During this manoeuvre, there was no incidence of complications such as accidental extubation, exposure of the wires or loosening of the connector after re-attachment. Time period for disconnection from the ventilator ranged from 1 to 2 minutes (mean, 1.6 minutes), and there was no significant oxygen desaturation in any subject during the procedure.

None of the subjects in the present study required postoperative ventilation. All 10 subjects were extubated in the operating room itself. The decision to extubate in the operation theatre was taken in consultation with the surgeon and the attending anaesthesiologist based on the clinical condition of the patient at the time of the surgical procedure, as well as intraoperative events.

Subjects were evaluated in the postoperative period at 1 week, 1 month and 6 months. No motor or sensory salivation deficit was found. Normal healing in the mucosa of the floor of the mouth was observed. No bleeding or infection in the area was noted. The scar has been well accepted by the subjects without any hypertrophic scarring or keloid formation [Figure 5].

Figure 3: Submental exit and stabilization of endotracheal tube with adhesive tape and sutures

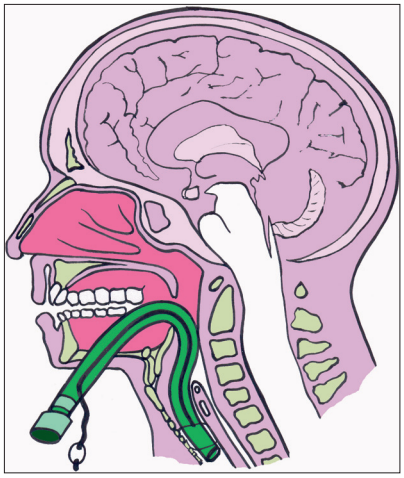

Figure 4: Schematic view of the tube position

Figure 5: Incision for submental intubation healed without scarring/keloid/fistula

Table 1: Demographic and clinical data of patients

Age	Sex	Maxillofacial fracture	Complication (intraoperative)	Complication (postoperative)	Duration of procedure (min)	Duration of postoperative ventilation
24	M	Le Fort III NOE* Mandible	None	None	5	Nil
20	M	Le Fort II NOE Mandible	None	None	6	Nil
35	M	Le Fort II NOE Mandible Alveolar	None	None	5	Nil
25	M	Le Fort III NOE Mandible	None	None	7	Nil
25	M	Le Fort II NOE Mandible Alveolar	None	None	5	Nil
29	M	Le Fort III NOE Mandible	None	None	5	Nil
29	M	Le Fort I NOE	None	None	6	Nil
32	M	Le Fort II NOE Mandible	None	None	7	Nil
22	M	Le Fort II NOE Mandible	None	None	5	Nil
21	M	Le Fort III NOE Mandible Alveolar	None	None	8	Nil

*Naso-orbital ethmoidal

DISCUSSION

Management of the airway is always a primary concern during any maxillofacial surgery. Operating in the field free from the intubation tube is comfortable for a surgeon; while for an anaesthesiologist, the safety of the tube and efficiency of ventilation are important. Modern techniques for surgical treatment of midfacial and panfacial fractures in maxillofacial trauma pose special problems for airway management.

Implementing a safe and acceptable alternative to tracheostomy for short-term airway management is a desirable objective for optimal management of complex craniofacial injuries. Nasotracheal intubation may best be avoided in these groups of patients because of reported dangers of nasotracheal intubation in the presence of midfacial and basilar skull fractures, such as cranial intubation, epistaxis, trauma to the pharynx, pressure necrosis of external nares, otitis media, sinusitis, sepsis and inability to pass a tube through nasal passages.[6-8] Often surgical correction of these nasal fractures requires tube-free surgical areas, which can be achieved by opting for avoidance of nasal intubations.

The alternative of orotracheal intubation significantly facilitates manoeuvres for reduction and stabilization of the jaws, which often requires immobilization with arch bars and wires. Hence oral intubation was avoided.

Anaesthesia via tracheostomy was the alternative route for short-term airway management. However, tracheostomy may cause many general, local, early and late complications. Early general complications include cardiac arrest caused by stimulation of vagus nerve, post-hypercapnic shock due to sudden lowering of the carbon dioxide level and aeroembolism. Early local complications comprise haemorrhage, subcutaneous or mediastinal emphysema and recurrent laryngeal nerve damage with all its consequences.[7,9,10] Late complications include laryngeal or tracheal stricture, haemorrhage from large blood vessels caused by decubitus of vessel walls, tracheo-oesophageal fistula, extensive granulation and inflammatory

complications.[11] Due to these potential complications, tracheostomy for airway management was avoided in our study subjects.

There have been several attempts to achieve short-term airway management, including retromolar intubation and nasal tube switch technique. According to literature, retromolar intubation has been reported to have disadvantages like being more traumatic, obtrusive, costly and requiring more operating time.[12] Another alternative nasal tube switch technique was not performed due to problems associated with the intraoperative re-intubation, like risk of aspiration due to posterior nasal bleeding, potential airway compromise with need for emergency tracheostomy/cricothyroidotomy, unfavourable manipulation of an unstable cervical spine, excessive stress on fixations with possible loosening of plates and screws.[13]

Since the first description, submental intubation has undergone various modifications and found new indications.[14] It could be safely used in patients with midfacial or panfacial fractures with possible base of skull fractures, as well as in patients undergoing elective Le Fort osteotomies or simultaneous elective mandibular orthognathic surgery and rhinoplasty procedure.[15,16] In our present series, submental intubations were possible in all the patients without any major complications, allowing unimpeded manipulation of the fractured fragments, satisfactory achievement of occlusion, establishment of maxillomandibular fixation and complete assessment of facial symmetry, as well as easy access to endotracheal tube for the anaesthesiologist. Moreover, extubation was found to be simple and the cosmetic results were acceptable, with no long-term morbidity.

In our series, no episodes of compromised airway or arterial desaturation occurred during the procedure. Other possible potential complications such as orocutaneous fistula, trauma to the submandibular and sublingual glands or canals, damage to the lingual nerve, and hypertrophic scar were also not observed.

Some precautions must be considered to make submental endotracheal intubation a successful technique with minimal morbidity. At every step, good communication between the surgeon and the anaesthesiologist is mandatory. Initial management of the airway of patients with facial trauma can be challenging. Submental intubation is always a second step after the airway has been secured. During the submental intubation procedure, the endotracheal tube must be firmly secured intraorally to prevent accidental extubation. To avoid injuries to the salivary glands and ducts, blunt dissection with the haemostat clamp must run in close approximation to the medial border of the mandible.

Another crucial decision during the management of patients with maxillofacial trauma is when to remove the endotracheal tube. Tracheal extubation of these patients must be done only after adequate evaluation. It is based on the patient's ability to maintain airway reflexes, the potential for residual respiratory depression, and airway oedema.[4] With the availability of modern craniomaxillofacial fixation techniques, maxillomandibular fixation is usually not required in the postoperative period.[17] Even if maxillomandibular fixation is required, in rare cases it need not be placed during the immediate postoperative period. Postoperative maxillomandibular fixation could be achieved by simple elastics after extubation. In modern maxillofacial trauma care, elastics are routinely used for achieving maxillomandibular fixation, instead of traditional wires. These elastics could be cut and removed easily by the patient himself or by any paramedical staff without the need for any specialized instruments. Hence if mechanical ventilation or intubation is required postoperatively, the submental intubation could be switched over back to standard orotracheal intubation.[18] However, if mechanical ventilation is expected to be required for prolonged period because of severe head or torso injury, tracheostomy remains the preferred technique for airway management.[18]

Some authors have recommended the technique of lateral incision through the body of mandible.[19,20] However, for two reasons we opted for midline approach as described by MacInnis: firstly, only few anatomic structures are present and there is minimum risk of neurovascular damage. Secondly, the midline incision heals almost imperceptibly and therefore is cosmetically superior.[21]

The present study reports good results with the use of submental endotracheal intubation for surgical treatment of 10 patients with panfacial fractures. In all cases, the planned surgery was completed without interference from the artificial airway and, most importantly, without compromising the airway.

CONCLUSION

Our series re-establishes that submental intubation is a useful alternative technique of airway management in patients with panfacial fractures. It demands a certain surgical skill without specialized equipments; however, it is safe and quick to execute. It allows intraoperative correction of occlusion and enables surgery for associated nasal fracture in the event of concomitant skull base trauma, and avoids the dangers of classical endotracheal intubation.

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